

SUPPORT FOR THE AMENDMENTS

The amendment to Claim 1 is supported by the specification at paragraph [0022], referring to U.S. 2007/0202405. Accordingly, no new matter is believed to have been added to the present application by the amendments submitted above.

REMARKS

Claims 1-19 are pending. Favorable reconsideration is respectfully requested.

The present invention relates to a powder of a layered lithium-nickel-manganese-cobalt composite oxide which is for use as a positive-electrode material for lithium secondary battery, which has a composition represented by the following formula (I), having a volume resistivity of $5 \times 10^5 \Omega \cdot \text{cm}$ or lower in the state of being compacted at a pressure of 40 MPa, and having a value of C/S, wherein C is the concentration of carbon contained therein (%) by weight) and S is the BET specific surface area thereof (m^2/g), of 0.025 or smaller:



where $0.04 < z \leq 0.91$, $0.1 \leq x \leq 0.55$, $0.20 \leq y \leq 0.90$, $0.50 \leq x+y \leq 1$, and $1.9 \leq \delta \leq 3$.

See Claim 1.

The rejection of the claims under 35 U.S.C. §112, second paragraph, is believed to be obviated by the amendment submitted above.

In amended Claim 1, the value of z, which is an excess quantity of lithium, is defined as set forth in the claim. This value defines the lower limit of the C/S value. When the “Li/(Ni+Mn+Co)” exceeds the constant ratio, the C/S value becomes greater. Thus, the definition of the lower limit of z to 0.04 or more, in which z defines the content of lithium, means that the C/S is not zero.

As set forth in paragraph [0033] of the specification:

In particular, there is the following tendencies in the composition range represented by formula (II). The closer the Li/(Ni+Mn+Co) molar ratio to the constant ratio of 1, the smaller the value of C/S but the higher the volume resistivity. Conversely, the larger the Li/(Ni+Mn+Co) molar ratio beyond the constant ratio, the larger the value of C/S but the lower the volume resistivity. Intensive investigations were made especially in order to cope with these inconsistent tendencies in the case where the Mn/Ni atomic proportion is 1 or larger and, as a result, the invention has been completed. It is important

that the two should be not larger than the respective specified values. [Emphasis added.]

In view of the foregoing, the claims are definite within the meaning of 35 U.S.C. §112, second paragraph. Withdrawal of this ground of rejection is respectfully requested.

The rejections of the claims under 35 U.S.C. §103(a) over Hosoya in view of Hampden-Smith and further in view of Shizuka are respectfully traversed. The cited references fail to suggest the claimed layered lithium-nickel-manganese-cobalt composite oxide.

The layered lithium-nickel-manganese-cobalt composite oxide of the present invention, when used as a positive-electrode material for lithium secondary battery, enables cost reduction and higher safety to be reconciled with improved battery performance. See paragraph [0009] of the specification.

The present inventors have found that by regulating a layered lithium-nickel-manganese-cobalt composite oxide having a composition in a limited range so as to have a volume resistivity not higher than a specified value and a considerably reduced carbon content, a powder of a layered lithium-nickel-manganese-cobalt composite oxide can be obtained which, when used as a positive-electrode material for lithium secondary battery, enables a. cost reduction and higher safety to be reconciled with improved battery performances. See paragraph [0013] of the specification.

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The value or C/S of the powder of a layered lithium-nickel-manganese-cobalt composite oxide of the invention is 0.025 or smaller, preferably 0.020 or smaller, more preferably 0.017 or smaller, most preferably 0.015 or smaller. In case where the C/S value thereof exceeds the upper limit, there is a possibility that the powder might give a battery showing enhanced expansion due to gas generation and having reduced battery performances. See paragraph [0039] of the specification.

Hosoya discloses to merely mix raw materials, and does not define the volume resistivity, the carbon content C, the BET specific surface area S, and the ratio C/S thereof. In addition, Hosoya does not perform a treatment of reducing carbon content such as an improvement of reactivity at carcination or likes by a selection of raw material, a degree of pulverization of raw material, achieving a higher specific surface area of raw materials, a degree of mixing raw materials and the like.

The “Li/(Ni+Mn+Co)” is up to 1.02 as a charging ratio in the working examples of Hosoya. It's often the case that Li is lost at a carcination stage due to a volatilization, and the Li excess amount of the resulting composition formula becomes lower than that of charging composition formula. Thus, the Li excess amount of the working examples of Hosoya is up to 0.02, which is close to constant ratio rather than the “Li/(Ni+Mn+Co)” of 1.04 and the Li excess amount (=z) of 0.04. In such case, as described in the paragraph [0033] of the present specification, the volume resistivity becomes higher, even if the C/S value becomes lower.

Even if merely synthesizing a lithium transition metal composite oxide as in Hosoya, anyone of the composition, the volume resistivity, and the C/S is excluded from the scope of the present invention, as in the Comparative Examples 1 to 4 (especially, the Comparative Example 2 is the closest to Hosoya even in view of Li content).

Thus, Hosoya does not disclose the present invention, and the present invention is not suggested by that reference.

In the present invention, as mentioned above, the definition of lower limit of z has the same meaning as the definition of the lower limit of C/S value. The present invention is not described in Hosoya, and the concept for the present invention cannot be easily expected from that reference. Moreover, Hampden-Smith and Shizuka fail to remedy the deficiencies of Hosoya.

In view of the foregoing, the combination of Hosoya in view of Hampden-Smith and further in view of Shizuka fails to suggest the claimed layered lithium-nickel-manganese-cobalt composite oxide. Accordingly, the subject matter of the pending claims is not obvious over those references. Withdrawal of this ground of rejection is respectfully requested.

Applicants submit that the present application is in condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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